



(11) **EP 2 105 407 A3**

(12) **EUROPEAN PATENT APPLICATION**

(88) Date of publication A3:
07.10.2009 Bulletin 2009/41

(51) Int Cl.:
C01B 31/02 (2006.01) **B01J 3/00** (2006.01)
B01J 3/04 (2006.01)

(43) Date of publication A2:
30.09.2009 Bulletin 2009/40

(21) Application number: **09004382.9**

(22) Date of filing: **26.03.2009**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL
PT RO SE SI SK TR**
Designated Extension States:
AL BA RS

- **Lee, Jin Seo**
Daejeon 305-770 (KR)
- **Do, Seung-Hoe**
Daejeon 308/721 (KR)
- **Hong, Seong Cheol**
Daejeon 305-720 (KR)

(30) Priority: **28.03.2008 KR 20080029333**

(71) Applicant: **Hanwha Chemical Corporation**
Seoul 100-797 (KR)

(72) Inventors:

- **Han, Joo Hee**
Daejeon, 305-345 (KR)

(74) Representative: **Albrecht, Thomas et al**
Kraus & Weisert
Patent- und Rechtsanwälte
Thomas-Wimmer-Ring 15
80539 München (DE)

(54) **Continuous methods and apparatus of functionalizing carbon nanotube**

(57) The present invention relates to a continuous method and apparatus of functionalizing a carbon nanotube, and more specifically, to a continuous method of functionalizing a carbon nanotube under subcritical water or supercritical water conditions without additional functionalizing processes, comprising: a) continuously feeding the carbon nanotube solution and an oxidizer under a pressure of 50 to 400atm, respectively or together, and then preheating the mixture of said carbon nanotube so-

lution and said oxidizer;b) functionalizing the carbon nanotube in the preheated said mixture under the subcritical water or the supercritical water condition of 50 to 400 atm;c) cooling down the functionalized product into 0 to 100°C and depressurizing the functionalized product into 1 to 10atm; and d) recovering the cooled down and depressurized product.

EP 2 105 407 A3



EUROPEAN SEARCH REPORT

Application Number
EP 09 00 4382

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	KI CHUL PARK ET AL: "Progressive and invasive functionalization of carbon nanotube sidewalls by diluted nitric acid under supercritical conditions" JOURNAL OF MATERIALS CHEMISTRY R. SOC. CHEM UK,, vol. 15, no. 3, 21 January 2005 (2005-01-21), pages 407-411, XP002540096	1,3-5, 8-14	INV. C01B31/02 B01J3/00 B01J3/04
A	* the whole document *	2,6,7, 15-18	
X	JP 2005 263607 A (UNIV SHINSHU) 29 September 2005 (2005-09-29)	1,3-5, 8-14	
A	* abstract *	2,6,7, 15-18	
X	US 2006/239891 A1 (NIU CHUNMING [US] ET AL) 26 October 2006 (2006-10-26)	13	
A	* paragraphs [0046], [0047], [0081], [0082] *	1-12,14	TECHNICAL FIELDS SEARCHED (IPC)
X	US 2006/097228 A1 (LEE JAE W [KR] ET AL) 11 May 2006 (2006-05-11)	15-18	B01J C01B
A	* paragraphs [0036] - [0043]; figure 1 *		
X	DE 103 00 559 A1 (DUESBERG GEORG S [DE]) 15 July 2004 (2004-07-15)	1-14	
A	* the whole document *		
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 11 August 2009	Examiner Marucci, Alessandra
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

 1
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 09 00 4382

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

11-08-2009

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2005263607 A	29-09-2005	JP 4035619 B2	23-01-2008
US 2006239891 A1	26-10-2006	NONE	
US 2006097228 A1	11-05-2006	JP 2006137953 A	01-06-2006
		KR 20060044194 A	16-05-2006
DE 10300559 A1	15-07-2004	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82